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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

MODEMS FOR SYNCHRONOUS DATA TRANSMISSION USING 60-108 kHz GROUP BAND CIRCUITS

ITU-T Recommendation V.36

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation V.36 was published in Fascicle VIII.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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**MODEMS FOR SYNCHRONOUS DATA TRANSMISSION USING
60-108 kHz GROUP BAND CIRCUITS**

*(Geneva, 1976; amended at Geneva, 1980,
Malaga-Torremolinos, 1984 and Melbourne, 1988)*

On leased circuits, considering that there exist and will come into being other modems with features designed to meet the requirements of the Administrations and users, this Recommendation in no way restricts the use of any other modems.

The only group reference pilot frequency which can be used in conjunction with this modem is 104.08 kHz.

1 Scope

The family of modems covered by this Recommendation should be applicable to the following uses:

- a) transmission of data between customers on leased circuits;
- b) transmission of a multiplex aggregate bit stream for public data networks;
- c) extension of a PCM channel at 64 kbit/s over analogue facilities;
- d) transmission of a common channel signalling system for telephony and/or public data networks;
- e) extension of Single-Channel-Per-Carrier (SCPC) circuit from a satellite earth station;
- f) transmission of a multiplex aggregate bit stream for telegraph and data signals.

Principal recommended characteristics to be used for simultaneous both-way synchronous operation are the following:

2 Data signalling rates

2.1 Application a)

The recommended data signalling rate (equals the customer signalling rate) for international use is synchronous at 48 kbit/s. For certain national applications or with bilateral agreement between Administrations, the following data signalling rates are applicable: 56, 64 and 72 kbit/s.

2.2 Applications b), c) and d)

For these applications, the recommended data signalling rate is synchronous at 64 kbit/s.

For those synchronous networks requiring the end-to-end transmission of both the 8 kHz and 64 kHz timing together with the data at 64 kbit/s, a data signalling rate of 72 kbit/s on the line is suggested.

The corresponding data format should be obtained by inserting one extra bit E just before the first bit of each octet of the 64 kbit/s data stream. The bits E convey alignment and housekeeping information, according to the pattern shown in Figure 1/V.36.

.... 1 octet 0 octet H octet 1 octet 0 octet H octet

FIGURE 1/V.36

The use of the housekeeping bits H is determined with bilateral agreement between Administrations. When not used, these bits should be assigned the value 1. A framing strategy is not specified in this Recommendation.

When the transmission of the 8 kHz timing is not required, the data signalling rate on the line may be 64 kbit/s.

2.3 Application e)

The recommended data signalling rate (equals the customer signalling rate) for international use is synchronous at 48 kbit/s. For certain national applications or with bilateral agreement between Administrations the data signalling rate of 56 kbit/s is applicable.

2.4 Application f)

The recommended data signalling rate is synchronous at 64 kbit/s.

2.5 The permitted tolerance for all the data signalling rates mentioned above is $\pm 5 \times 10^{-5}$ bit/s.

Note - There are equipments in service which will only work successfully with a maximum tolerance of the data signalling rate of ± 1 bit/s.

3 Scrambler/descrambler

In order to be bit sequence independent and to avoid high amplitude spectral components on the line, the data should be scrambled and descrambled by means of the logical arrangements described in Appendix I.

4 Baseband signal

The equivalent baseband signal shaping process is based upon the binary coded partial response pulse, often referred to as class IV, whose time and spectral function are defined by:

$$g(t) = \frac{2}{\pi} \cdot \frac{\sin \frac{\pi}{T} t}{\left(\frac{t}{T}\right)^2 - 1}$$

and

$$G(f) = \begin{cases} 2 T f \sin 2 \pi T f, & |f| \leq \frac{1}{2 T} \\ 0 & , |f| > \frac{1}{2 T} \end{cases}$$

respectively, where $1/T$ denotes the data signalling rate.

This shaping process should be effected in such a way that the decoding can be achieved by full wave rectification of the demodulated line signal.

The reference to equivalent baseband signals recognizes that the modem implementation may be such that the binary signal at the input and output of the modem is converted to and from the line signal without appearing as an actual baseband signal.

5 Line signal in 60-108 kHz band (at the line output of the modem)

5.1 In the 60-108 kHz band the line signal should correspond to a single sideband signal with its carrier frequency at $100 \text{ kHz} \pm 2 \text{ Hz}$.